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APRIL, 1939 VOLUME XVI, NO. 4

HEALTH HAZARDS IN CHEMICAL INDUSTRY

THE YOUNG CHEMIST AND THE GOVERNMENT SERVICE

CHEMIST ADVISORY COUNCIL

Seventeenth Annual Meeting
THE AMERICAN INSTITUTE OF CHEMISTS
to be held at
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MAY 13, 1939

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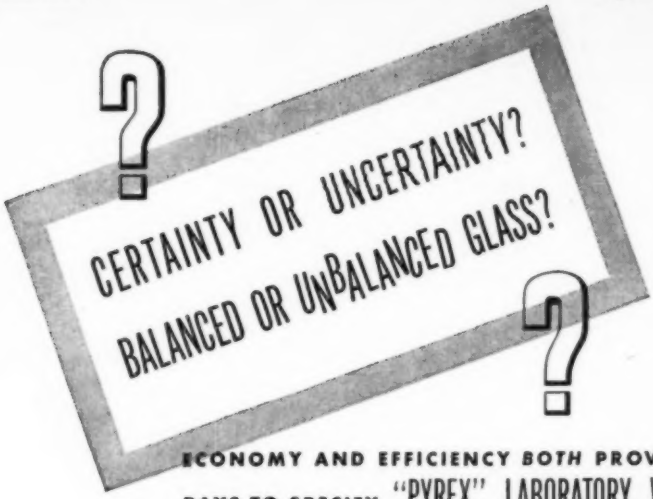

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Health Hazards in Chemical Industries

By Henry F. Smyth, Sr.

A talk given at a meeting of The Pennsylvania Chapter, The American Institute of Chemists, Philadelphia, February 21, 1939, by the Assistant Professor of Industrial Hygiene at the University of Pennsylvania.

correction on p. 284

IN CONSIDERING the subject of the health hazards connected with chemical industries, two facts must be borne in mind. On the one hand, it is safest to assume that all chemicals may be potentially toxic unless definitely known to be otherwise. Indeed, there are almost no chemical materials used or manufactured in industry that are not associated with some degree of health hazard even though used with reasonable care, since few if any of them are absolutely inert. On the other hand, it is felt that there are no chemical materials, however active and however toxic, that cannot be produced or handled with a reasonable degree of safety, provided we learn and properly evaluate their potential hazards and are willing to pay the price of protection. The price may be not only the cost of careful use, but also the cost of providing proper equipment, and of proper operation and upkeep of such equipment.

It must be realized, moreover, that although we can fairly well evaluate the degree of toxicity of specific chemicals, and so the likelihood of harm from continuing exposure to them, yet all such estimations are relative. There is almost always an unpredictable degree of variation in personal susceptibility to chemical poisonings, some individuals being far more resistant, and others far more susceptible than the average to the action of certain chemicals. Susceptible subjects may be affected harmfully by exposures safe for the average.

With this in mind, we protect the average worker by making sure that his exposures are kept below the accepted safe limits, and protect the susceptibles by pre-employment and periodic medical examinations; pre-employment, to detect the presence of weakness or pathology in organs or systems likely to be harmed by excessive exposures, so that susceptibles may not be put to work under dangerous conditions for them; periodic examinations, to detect beginning damage so that susceptibles may be removed from exposures evidently harmful to them,

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while there is still ample opportunity for recovery from such exposures.

Some workers may develop increased resistance to certain substances after continuing exposure (as may carbon tetrachloride workers, due to the fact that liver damage from this material, if not too excessive, may result in regeneration of tissue more resistant to this specific material than was the original tissue). Others, on the other hand, may work for some time with many other chemicals with apparent impunity, and then eventually develop a state of sensitization to these materials, so that they cannot safely be exposed to even minimum concentrations. Here, also, the periodic medical examination detects early damage and can confirm this result by so-called "patch tests" on the skin with the specific materials.

In fact, we feel very strongly that adequate competent medical service should be a necessity with any chemical industry—full time service for the larger industries, and part-time service of physicians definitely trained in industrial medicine for the smaller industries.

Portals of Entry into System

In industry, chemical substances may poison: 1. By *ingestion*, the least frequent method, and usually only secondarily, due to the swallowing of dust entering by mouth or nose; 2. By *inhalation*, as dust, vapor, fume or gas (the most frequent method of entry in industry); or 3. By action, (a) on the skin, producing localized inflammation, or (b) on the general system, by absorption through the skin and distribution through the circulation to cause systemic poisoning. Practically all of the fat or oil solvents are likely to produce poisoning by this route.

Physical State in Which Chemicals Harm

Chemicals may do harm as:

1. *Dusts*, which may be, (a) *infective*, associated with disease-producing organisms, as in woolsorters' disease from inhaling anthrax-laden dust from wool, or as in tuberculosis from inhaling dust contaminated by expectorations from fellow-workers; (b) *obstructive*, not definitely poisonous, but by mass action (when in excessive amount) interfering with secretion and producing local irritation in eyes, nose, throat, or bronchi; (c) *irritant*, acting locally as chemical irritants or escharotics, as may the chromates which may cause intractable ulcerations on the skin, as in the so-called chrome holes on kid tanners' hands, or on nasal mucous membranes, often proceeding to perforations of the nasal septa, but not usually entering the circulation to cause systemic poisoning; (d) *soluble and toxic*, being absorbed from gastro-

intestinal or respiratory tract and causing systemic poisoning, as may lead, manganese, arsenic, or other metallic dusts and many organic dusts; (e) *fibrosis-producing*, entering the lungs and producing the chronic fibrotic changes of pneumoconiosis or silicosis. In this last group belong free silica, asbestos, and possibly a few other silicates. This condition, harmful in itself as it interferes with lung expansion and consequently with air intake, is especially dangerous as it tends to aggravate existing pulmonary tuberculosis or to lay a good foundation for subsequent infection.

2. *Liquids*, which may be, (a) *irritant*, (b) *corrosive*, (c) *toxic*, or (d) *sensitizing*.

3. *Vapors, fumes* or *gases*, which may be, (a) *asphyxiant*, harming either by simply replacing oxygen in inspired air (as do simple asphyxiants such as carbon dioxide), or by replacing oxygen in the red blood cells (as do chemical asphyxiants such as carbon monoxide); (b) *irritant*, producing inflammation of eyes, nose, throat, larynx, bronchi, or lungs, as do ammonia (which rarely reaches the lungs, but, when in very high concentration, strangles by closing the glottis) and bromine or nitrous fumes (which reach the lungs and produce pulmonary oedema and pneumonia, if they do not kill outright); (c) *toxic*, as inorganic or organic gases, vapors or fumes which poison the system but do not produce much local lung damage if not in high concentrations, or organo-metallic gases, vapors or fumes such as tetra-ethyl lead, (which is absorbable as liquid or vapor via skin or lungs).

Chemical State in Which Chemicals Act

We have just considered the physical state in which chemicals may harm. The chemical state is also of importance. Toxic substances may act in one of three forms: 1. As *direct tissue poisons*, circulating and producing harm as such (for example, methyl alcohol, hydrocyanic acid, cyanates, or hydrogen sulphide); 2. through *intermediate products*, when not fully oxidized, as does phenylenediamine, the harmful action of which is due to quinones; or through *harmful end products*, as does phosgene gas, the action of which on the lungs is due to the liberation of nascent hydrochloric acid formed by the action of moisture in lungs, alveoli, and bronchi.

Organs Affected

Chemicals may affect: 1. The *lungs*, usually acutely, as do bromine, phosgene, etc.; 2. the *glandular organs*, such as the liver, which is injured by phosphorus, carbon tetrachloride, etc., or the kidneys, which are especially harmed by mercury and phenol; 3. the *circulatory organs*,

such as the blood and blood-making organs, which are damaged by benzol and its aromatic derivatives; or 4. *the nervous system,* which is affected by petroleum distillates, carbon bisulphide, manganese, etc. While chemicals often predominatingly act on one of the above tissues or systems, they usually also affect the other systems more or less, differences of action depending on time and concentration.

Degrees of Toxic Action

Effects produced by chemicals may be: 1. *Acute* and immediate, in which case exposures are usually accidents and eventuate, if discontinued promptly, in death or recovery; 2. sub-acute or *chronic,* slowly developing and in some instances not recognized for days, weeks, months, or even years, as may be the case with lead or benzol; or 3. *cumulative,* due to slow elimination and consequent storage in the system, as lead may be stored in the long bones. Such cumulative poisonings may not be recognized until after the worker has been transferred to another unrelated industry, as may be the case with lead or benzol poisoning. At times these harmful effects, if exposures have been heavy or continued, may progress to a fatal termination months or years after exposure is discontinued, as has happened in some of the cases of radium poisoning.

Measuring Known Hazards

The degree of damage to the average worker, of any material, is dependent first upon the nature of the material itself; then upon the amount of the material to which the worker is exposed or takes into his body; the duration of the exposure; and the temperature under which the individual works. We shall deal with the determination of the specific toxicity of the material itself under the next heading.

The degree of exposure may be measured in one of several ways, depending upon the nature of the toxic material: 1. By concentration in the working atmosphere, measured as (a) parts per million by volume, if a gas or vapor; (b) as milligrams per liter or cubic meter, if a spray or soluble toxic dust; or (c) as particles per cubic foot, if fibrosis-producing or obstructive dusts, considering only those under ten microns in greatest diameter as harmful (except with asbestos, where no size limits have been set). 2. By milligrams per unit of body weight for materials entering the digestive tract. 3. By milligrams per one hundred cubic centimeters of blood serum, as an indication of the amount actually absorbed and producing toxic effect. 4. By amount excreted per twenty-four hours in the urine, as an indication of the amount having passed through the system.

In addition to the amount of exposure or absorption as measured above, the possibility and extent of toxic action is dependent upon the continuity and duration of exposure. Safe working conditions and concentrations for continuing exposures are measured on the basis of eight to ten hours exposure for five to six days per week, so that a job analysis is essential to determine the risk to particular workers. It is usually possible to stand definitely higher concentrations than the so-determined maxima, provided exposures are discontinuous and for shorter periods. While one hundred parts per million is given as a safe maximum for benzol or for carbon tetrachloride, we have been exposed to seven thousand p.p.m. of the former, and over one thousand p.p.m. of the latter for shorter periods when measuring industrial concentrations, with no ill effects other than temporary discomfort, although physical examinations and histories of workers under these conditions showed that they were being progressively injured.

It must also be realized that high temperatures increase concentrations of volatile matters in the air, and that high temperatures and hard manual work lower resistance and increase amounts of vapor absorbed by increasing respiratory activity.

Evaluating Unknown Chemical Hazards

When chemicals of unknown toxicity are being introduced into industry, it is always advisable to determine potential harmfulness *before* general use, rather than after suits have been brought for illness or death of workers. Striking examples of instances where employers have suffered heavily for failure to do this were the deaths in the early manufacture of tetra-ethyl lead, and those among the painters of radium dials for clock faces.

A program for such a study, to be adequate, must extend over a considerable time interval in order to evaluate the possibility of slowly developing toxic poisoning, which is the most frequent and the most often overlooked form of industrial poisoning. A preliminary study should determine the acute toxicity or minimum lethal dose (m.l.d.) for laboratory animals, but should never end there. (We are forced to use animals for these evaluations as it is not safe to use humans for such determinations.) The m.l.d. so determined, is used as a basis for chronic toxicity work. In using animals it is always advisable to use more than one species, to use adequate numbers so as to be able to draw conclusions as to average effects (since animals as well as humans vary somewhat in susceptibilities), and to continue feedings, inhalation exposures, or skin absorption tests over sufficiently long

periods to give indications as to the effects of continuous working exposures.

For chronic work, rats are the small animals of choice, being nearest to humans in their dietary habits, and having a short life period and correspondingly rapid metabolism, so that months of rat life may be nearly comparable to years of human life. As they are rapid multipliers with short gestation periods, a six to nine months' exposure period gives an opportunity to evaluate the effect of exposures on fertility and gestation as well as other toxic effects on the individual animals. For comparison, mice, guinea-pigs, rabbits, cats, and dogs may be used, although expense and available space limits the use of cats and dogs. We prefer, when possible, to check conclusions based on many small animal exposures on a few rhesus monkeys, as approaching a step nearer to human conditions.

In using rats, one should expose (gas or feed) groups of twenty or more to each of at least four concentrations of fractional amounts of the m.l.d. (say, 1/5, 1/10, 1/20, and 1/40) of the material to be tested, and continue exposures for from three to twelve months of eight hour days, five or six days a week. During this time the animals should be checked weekly as to weight, general condition, excretions, etc., and blood and urine examinations should be made weekly. Evidence should be sought, not only as to developing pathology, but also as to amount and form of elimination of test materials, as an indication of possible tests of value in estimating the potential effect on workers. All exposed animals dying, and all surviving animals, should be autopsied and tissue studies made for comparison with tissues of a group of normal control animals kept under similar living conditions but having had no exposure to the test materials.

Having determined safe maximum exposures for animals, these may be used tentatively as possible safe limits for humans, but the materials so studied should be used only where careful checks and observations on the exposed workers can be carried out. (Threshold values for brief exposures may at times be determined on small groups of carefully selected and controlled human subjects, provided these exposures are stopped at the earliest indication of specific action.) Only after continued observations of this type have been made, should the material be introduced generally into industry, with recommendations as to the precautions which should be heeded in its use.

Where tests are to be run on materials which have already been introduced into industry before their toxicity is known, the above work

should be supplemented by a series of measurements of concentrations under working conditions and by job analyses, to indicate the usual degrees of exposure, all correlated with physical examinations of large numbers of workers under varying conditions.

As an example of what we consider an adequate study, a study made to determine safe methods of using a certain volatile solvent, included three hundred and thirty animal exposures to five different concentrations for periods up to ten and one-half months, using guinea-pigs, rats, and monkeys; surveys of five plants manufacturing the material and of several dozen using it, with two thousand interferometer measurements of concentrations in working areas; and physical examinations of one hundred workers with measured exposures. (This number of physical examinations should have been at least doubled, but the workers were not available for examination.)

This seems like a very elaborate and expensive program, but potential danger so determined and guarded against is much to be preferred to even a few damage suits for illness or death with awards against the industry, the whole study costing less than a single suit for death.

Protective Measures

Having recognized and determined toxic hazards, we have available various methods of protecting workers so that useful, though dangerous chemicals may be safely manufactured and used. Some of these methods are:

1. *Substitution* of a similar but less toxic material. This is not a good method. It is much better to learn how to use safely a hazardous material than to discard it for a possibly less useful substitute often of unknown toxicity. This method frequently lends a false sense of security and encourages careless use of substitutes.

2. Installation of *exhaust ventilation* adequate to remove toxic materials *at the point of production* before they have a chance to penetrate working atmosphere. Booths or hoods may or may not be needed here. Never depend on general exhaust ventilation from ducts with inlets remote from points of production, as this disseminates harm rather than removes it. An example of this occurred in a textile leather plant in a neighboring state where three deaths were probably attributable to the placing of an air intake for drying chambers in the center of the ceiling of a large room where a number of coaters were working. The men were using material which was about 50 per cent benzol, and the intake so installed created a current of the

material from the working surface, past the noses of the workers, to the intake.

3. *Isolation* of processes so as to avoid the risk of general plant exposures.

4. *Shortening of necessary exposures* of unprotected men, and alternating dangerous with safe jobs.

5. Provision of *personal protection* of workers by: (a) Adequate *respirators* if exposures are discontinuous and if workers must be active over considerable areas; (b) *positive pressure air helmets,* face masks or respirators supplying more air than needed for respiration so that leaks are always out and never in. They furnish excellent protection, if properly supplied with clean pure air, and if supplied with overhead airlines they allow of considerable mobility; (c) *protective non-absorbent clothing;* (d) *protective skin applications,* for hands, arms and face, often preferable to gloves which, if defective, may act as poultices. Applications are now available on the market to protect against either water-soluble or oily materials.

6. *Adequate upkeep* and good housekeeping maintenance, so that safe devices remain safe. This should include *periodic* checks on functioning of apparatus and on atmospheric concentrations. Frequently, elaborate exhaust systems which offered adequate protection when first installed and put into operation have been found entirely shut down "for the sake of economy", or so clogged by dusts as to be of little value.

7. *Pre-employment physical examinations* to exclude those who are likely to be particularly susceptible.

8. *Periodic physical examinations* to remove temporarily or permanently those showing early symptoms or signs of toxic effect, and also to indicate the need of increasing protective measures.

Conclusion

In conclusion, let us repeat that it is possible to use any essential chemical in industry with safety, provided we learn its potentialities of harm and how to recognize early harmful action, and provided we are willing to pay the price—in money, in equipment, and in vigilance—to make and *keep* conditions safe.

Members of The American Institute of Chemists are invited to make the Institute's office in the Science Building at the World's Fair their headquarters when they visit the Fair. (See page 202.)

The Young Chemist and the Government Service

By Louis Marshall

The fourth of a series of articles dealing with the opportunities for the chemist in the Government Service.

The Department of Agriculture

The branch of our Government which employs more chemists than any other is the Department of Agriculture. It is headed by a Secretary of Agriculture, who is a member of the President's Cabinet. He is charged with the task of promoting agriculture in its broadest sense. The amazingly vast organization of this Department is divided into bureaus in which widely diversified and important researches are conducted.

One of its most important subdivisions is the Bureau of Chemistry and Soils. It is primarily a research organization for the study of fertilizers, of soils, and of the products of the soil. Since, in the last analysis, the prosperity of the nation rests upon its agriculture, the importance of the work is easily apparent.

Regional Laboratories

An act of great importance to agriculture and to the men engaged in agricultural sciences occurred on February 16, 1938, when the President signed the Agricultural Adjustment Act of that year. Among other provisions, this legislation authorizes large-scale researches looking toward the discovery of new uses for farm products, particularly those which are characterized by regular or seasonal surpluses. Its purpose is to improve the economic status of the farmer by creating a wider market for his goods. The Act provides a million dollars each, for the establishment of four regional laboratories, one in each major farm producing area of the country, and future appropriations to these institutions are likewise to be divided equally among them.

A committee of the Department of Agriculture, under whose auspices these laboratories are to function, made a preliminary study of the agricultural conditions which this Act of Congress is designed to improve, and decided to establish the laboratories in the Northern, Eastern, Southern, and Western areas of the nation. The Northern laboratory, which is to be located at Peoria, Illinois, will study the agricultural problems presented by the twelve states of Illinois,

Indiana, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Ohio, Wisconsin, and Michigan. It is expected that the early work of this Northern laboratory will concern itself with such items as corn, wheat, and agricultural waste products. The man who was selected to direct the work of the Northern laboratory is Dr. O. E. May, F.A.I.C., who entered the Bureau of Chemistry and Soils in 1923 and whose work won for him promotions in the various grades of Chemist. He is well known for his activities as director of the Soybean Industrial Products Laboratory at Urbana, Illinois.

The Eastern laboratory, which will be located at Wyndmoor, adjoining the city of Philadelphia, will devote itself to a study of such materials as tobacco, milk products, apples, potatoes, and vegetables. It will be the headquarters for the research activities required by the following sixteen states: Connecticut, Delaware, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Tennessee, Vermont, Virginia, and West Virginia. The director of the Eastern laboratory is P. A. Wells, F.A.I.C., who was formerly in charge of the Industrial Fermentations Section of the Bureau of Chemistry and Soils. He has achieved distinction in this field, and although a young man—he was born in 1906—he has been adjudged capable of directing this huge enterprise.

The Southern region, which will have its headquarters at New Orleans, embraces the nine states of: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, South Carolina, and Texas. The products which will engage the early attention of its research laboratory include cotton, sweet potatoes, and peanuts. The man who was selected to direct the work of the Southern regional laboratory is D. F. J. Lynch, F.A.I.C. Like his fellow directors, he entered the Bureau of Chemistry and Soils in a minor capacity and won promotion through the quality of his work. He is well known for his important researches which led to a method for the production of a high grade of cellulose from the sugarcane bagasse.

The Western laboratory will endeavor to answer the needs of the eleven states of: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. It will be advantageously located at Albany, California, on a twenty acre plot of land close to the University of California, whose research library will be available to its staff of scientists. The work of this laboratory will concern itself with such products as wheat, alfalfa,

Irish potatoes, vegetables, and fruits other than apples, which will be studied in the Eastern laboratory. Dr. T. L. Swenson has been chosen to direct this work. He, also, worked at the Bureau of Chemistry and Soils, in the field of enzymology.

All four regional laboratories will be under the general supervision of H. T. Herrick, who is familiar with the proposed type of work because of his activities as head of the Industrial Farm Products Division of the Bureau of Chemistry and Soils. He was recently appointed assistant chief of the bureau, serving under the chief, Dr. Henry G. Knight, F.A.I.C.

The buildings in which all of the researches are to be conducted, will be erected in the near future. They will all be of the most modern design and construction, fireproof and air-conditioned. They will be U-shaped structures of three stories and basement, and will contain not only research rooms, but also space for heavy engineering equipment, service shops, offices, libraries, and conference rooms. All of the features which long experience has proven to be desirable in furthering research work of the character contemp'ated will be incorporated in each building.

It is expected that when the four regional laboratories get into their full stride, nearly a thousand scientists of varying specialties and technicians will be at work in them. The physical working conditions at all four institutions will doubtless leave nothing to be desired and, in whimsical vein, it is perhaps not untrue to say that their establishment embodies the answer to many a chemist's prayer.

Bureau of Chemistry and Soils

In order to carry out its diversified activities, the Bureau is divided into the following research divisions: Carbohydrate, Chemical Engineering, Fertilizer, Food, Industrial Farm Products, Naval Stores, Protein and Nutrition, Soil Chemistry and Physics, and Soil Survey.

The Carbohydrate Research Division

The Carbohydrate Research Division coöperates with other bureaus of the Department in determining the chemical composition and properties of the juices of new varieties of sugar cane. The cultivation is then encouraged of those varieties which show promise of finding a market. Many plantation sugar houses in the country produce molasses as a by-product. This molasses contains sulphites which, according to Federal and State laws, must not exceed a certain proportion. In

order to remove the sulphites, the Division worked out a method of oxidizing them by means of chlorine and hypochlorite. The process resulted in an improvement in the flavor of the product, and a trial of the method in a commercial plantation sugar house gave satisfactory results. In time, the general adoption of the method will probably improve the quality of molasses, and the market for it.

Another discovery of the Division was that a simple method of reducing the deterioration of sugar cane was to sprinkle water over the cane stored in piles. Sugar cane syrup is another carbohydrate which has engaged the attention of the Division. This product ranks next to cotton as a cash crop in some counties of the states bordering the Gulf of Mexico. Competition with other syrups makes it necessary for the farmers to manufacture a product of high quality and of uniform quality. To assist them in this endeavor, the Bureau has sent men to give demonstrations at selected points on the latest and best methods of making a high quality product. Thus the results of the laboratory investigations are made readily available to large and small producers who are encouraged to put into practice the latest and most efficient methods. This is one of the ways by which the Department of Agriculture seeks to correlate laboratory findings with their practical application on the farm.

Another important investigation has dealt with the study of honey. This wholesome and nutritious foodstuff has an annual production in the United States of about one hundred and fifty million pounds, with a farm value of approximately eleven million dollars. The sale of a considerable portion of this product, however, is often made difficult because of certain defects such as turbidity, foaming, formation of surface scums, excessive color, granulation, and a tendency toward caramelization when the honey is heated to only slightly elevated temperatures. Recently, as a result of studies of the chemical composition and technology of honey processing, the Division completed a highly successful method for making a commercially desirable product. Emulsified air and surface scums are eliminated, granulation is prevented, the complete flavor of the honey is retained, and the resulting product has a very attractive color which is suitable for packing in glass containers. The method bids fair to revolutionize the handling of extracted honey, and will probably extend the market for the product both in this country and abroad. It has been made available to the beekeeping industry through the issuance of a public service patent for

purifying extracted honey. The patent is numbered 2,070,171 and was granted February 9, 1937.

The Division has studied the preparation of levulose syrup from chicory roots. An intermediate product in this process is calcium levulosate which has given difficulty because it filters very slowly. It was found, however, that if the liquid is allowed to stand for about forty minutes after liming to produce the calcium levulosate, the filtration can be carried on more rapidly. The reason seems to be that, after standing, the organic salt becomes more granular and therefore easier to filter. The properties of levulose syrup make it appear that a market for the product can be developed. It is hydroscopic, soluble in water, and difficult to crystallize. The syrup can therefore be used in baking to retard loss of moisture, and to delay the staling of sweet goods. It may be used in tobacco products to insure the retention of moisture, and in certain food products which cannot use ordinary sugars because of their tendency toward crystallization.

In the field of starches, another achievement can be recorded: The development of a method, suitable for industrial application, of producing starch from sweet potatoes. The Division, in fact, operates a farmers-coöperative plant at Laurel, Mississippi, for this purpose. It was recently found that sweet potato starch has a decidedly strengthening effect on cotton fabrics.

The investigations on oils, fats, and waxes are also carried out under the auspices of the Carbohydrate Research Division. As an example of its work, the determination of the constants of refined raisin-seed oil can be cited. The saturated and unsaturated fatty acids occurring in the oil were analyzed to establish their identity. Raisin-seed oil, which is obtained as a by-product in the raisin industry of California, is expressed from the seeds and refined. It finds use in the manufacture of certain cosmetics, and in salad dressings. Similarly, the oils from different seeds and plants are investigated to determine their suitability for foods, or for paints or varnishes. Some time ago, for example, the Government of Haiti sent samples of mahogany tree seeds for examination as to their oil content. It was found that the petroleum ether extract of the decorticated seed was a mixture of oil and resins, and contained about eight per cent of unsaponifiable matter. The extract was not suitable for foodstuffs, and seemed to possess no characteristics which would make its commercial exploitation attractive.

Food Research Division

The type of work done by the Food Research Division is indicated by its title. One recent investigation has dealt with methods of baking and baking formulas to produce bread of better keeping quality. This work is important because of the large daily losses sustained by bakers on account of the staling of bread.

Another field of investigation has dealt with the study of the toxicity of insecticides to higher animals. The purpose of this work was to determine if chronic intoxication may result from eating foods contaminated with insecticide spray residues. A study of fluorine poisoning, for instance, revealed that the bone phosphatase activity of young growing rats poisoned with fluorine compounds, was less than that of control animals. As maturity approaches, however, the phosphatase activity becomes nearly the same in both cases. The X-ray structure of the bones and teeth of rats fed on a diet of the fluoride mineral cryolite is to be studied to determine the amount of fluorine in these organs and to gain information on the position of the fluorine atoms in the bone structure. The blood of rats fed on a diet containing cryolite gave a reduced red-cell count. This anemia may be a more delicate index of fluorine toxicity than is the mottling of teeth. The toxic effects of such drugs as methyl and lauryl thiocyanate, derris, pyrethrum, and phenothiazine are also being studied.

In connection with studies on the toxicity of phenothiazine, it was found that substances excreted in the urine following administration of this compound conferred bactericidal properties on the urine. This discovery led to the deduction that phenothiazine may be of therapeutic value in treating the diseases of the urinary tract caused by bacteria. A collaborating physician employed the compound in the treatment of human cases of cystitis or inflammation of the bladder, and obtained very promising results.

A problem of a different nature which engaged the attention of the Division had to do with the discovery of methods for preventing the development of rancidity of edible oils and oil bearing foods. It had long been known that some relationship existed between light and the decomposition of many organic substances. One of the chemists of the Division found, after a long series of experiments, that while the exposure of oils to certain wave lengths of light promoted rancidity, green light of wave length 4900 to 5800 Angstrom units was most efficient in retarding it. This was found to be true of such oil-bearing foods as butter, salad oil, lard, pecans, potato chips, mayonnaise, etc.

Many manufacturers are utilizing this knowledge by putting their products into containers which transmit only green light, or by wrapping their products in green paper. In view of the fact that about two billion dollars of oil-bearing foods are marketed yearly, the importance of a method for preventing rancidity requires no emphasis.

The Division has also conducted researches on soy beans which are becoming increasingly important as a source of lecithin. The latter is used in medicine, in food products, and as an emulsifier in industrial products. It was found that when soy beans, which contained twelve to fourteen per cent of moisture, were stored at room temperature during the summer months, considerable losses of lecithin occurred. When stored at a lower temperature however, the beans suffered but a slight loss of the substance.

The Division is doing considerable work on plant pigments. Its recent efforts were directed toward determining the structural formula of a gelactoside isolated from the skins of certain apples. These efforts have not yet been successful, but the work is continuing.

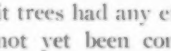
Some time ago, the Division was called upon to investigate certain difficulties encountered by walnut growers of California. In the trade, it was known that walnuts having light-colored kernels had a greater value than those whose kernels were heavily veined or dark-colored. Experience has taught the growers that a maximum number of light-colored kernels could be obtained by harvesting the walnuts early. When this was done, however, it was found that the hulls of many of the nuts were tight and difficult to remove. This was the problem investigated by the Division, and its work disclosed that if the walnuts were treated with air containing ethylene gas, the hulls were loosened. The discovery has found practical application in the plants of many of the growers. One of the recent publications of the Bureau of Chemistry and Soils dealt with the subject of treating fruits and nuts in atmospheres containing ethylene.

One of the important fields of investigation of the Division is the study of citrus fruit products. Field laboratories are maintained at Winter Haven, Florida, and Weslaco, Texas, for this purpose. The products that are studied include orange and grapefruit juices, orange oil, citrus candy, alcoholic citrus beverages, grapefruit marmalade, and grapefruit vinegar. The laboratory at Florida worked out a method for the packing of orange juice using the devices of de-aeration and flash pasteurization. The method is now used by a commercial firm

which installed a plant capable of packing one thousand six hundred bottles of juice of twelve ounce capacity per hour. The product has become so popular that despite this large capacity, the plant is unable to meet the demand. Here again is illustrated the immense practical importance of the experimental work of the Department of Agriculture. Its achievements in science are of direct and lasting benefit to consumer, producer, and distributor. The Florida laboratory is comparatively small, the professional staff consisting of one senior chemist, one assistant chemist, and one junior chemist. In the laboratory at Weslaco, investigations are carried out on the preparation of wines from oranges, grapefruit, sweet lemons, sweet limes, and tangelos. It was found that wines having an alcohol content as high as eighteen per cent could be produced if the acidity were kept below eight tenths of a gram of citric acid per hundred cubic centimeters. This laboratory has also conducted experiments to determine whether insecticidal tartar emetic sprays used on grapefruit trees had any effect on the composition of the fruit. The work has not yet been completed, but preliminary data obtained by the analyses of grapefruit indicate that the sprays have no effect on the composition. The Texas laboratory employs one full chemist and one junior chemist to carry out its work.

The Food Research Division has a section devoted to the study of enzymes. One of its achievements has been the identification of a protein-splitting enzyme found in wheat flour. A knowledge of the action of this enzyme has already been applied to improving the baking quality of those flours which yield hard doughs. The method is to add the protein-splitting enzymes occurring in normal flours to the abnormal ones which then become capable of producing softer and more pliable doughs.

The work of the Division on the important problem of determining the best freezing methods for the preservation of fruits showed that moderate storage temperatures of 15 to 20 degrees Fahrenheit were more destructive of micro-organisms than sub-zero temperatures.



The American Institute of Chemists will have an office in the Science Building at the World's Fair. All members are requested to register at this office and will be given souvenirs at the time they register. There is no registration fee. Information about the place of the luncheon and dinner at the Annual Meeting on May 13, 1939, will also be available here. (See page 208.)

George C. Lewis

THE AMERICAN INSTITUTE OF CHEMISTS deeply regrets the death of its honorary member, George C. Lewis, who died at his home Monday, December 19, 1938, in New York, N. Y.

Mr. Lewis, a native of India, was educated in England, and served as a British naval officer in the Boer War, and in the Boxer campaign in China. He came to the United States in 1904 and joined the L. Martin Company at once, rising rapidly to the presidency of the firm. He was a director of the Columbian Carbon Company, of which the L. Martin Company is a subsidiary; the Monroe Louisiana Carbon Company; the Darco Company; and the United Lamp Black Works, of London.

Mr. Lewis was a former president of the New York Chemist's Club and of the British Schools and University Society. He was a member of the Pilgrim Society, the St. George's Society, and the Montauk Masonic Lodge of Brooklyn. He held more than twenty patents on the manufacturing of lamp-black and other carbon products.

Frederick J. Kenney

WITH the death of Frederick J. Kenney on February 23, 1939, THE AMERICAN INSTITUTE OF CHEMISTS has lost a member whose personal activity on its behalf was only a portion of the services by which it benefitted from his membership. His warm friendliness, his broad and keen interest in people, as well as his innate goodness served by example to draw men to him and endow him with the faculty of leadership.

He was born in Newark, New Jersey, on January 19, 1878, and was graduated from the New York College of Pharmacy as a graduate in pharmacy in 1897. Thereafter, he was assistant chemist in the New York City Department of Health until 1908, and chemist of the Department of Public Welfare until 1919. In this time, he had ample opportunity to practice the arts of manufacturing pharmacy and through them to become familiar with operations on a wholesale scale and with sources of supply of a wide variety of materials.

With this background, he was appointed chief chemist of the New York City Department of Purchase in 1919. He brought to this

position the personal qualities and knowledge and the warm tolerance of humanity which were inherent in him, and by exercise of these built up the Department of Purchase to its proper position as supervisor of the vast volume of supplies bought by the City of New York.

In 1935, he retired from the city's service to form the consulting firm of Kenney-Herstein, Inc. However, within a year an acute heart attack made imperative his retirement from all business activities.

In spite of this, he did not permit his many outside interests to suffer. In fact, he willingly added other duties. For a time, he was editor of *The Percolator,* published by The Chemists' Club (New York); a member of its Finance Committee and Board of Trustees. He was very active in the Seventh Regiment Veterans' Association and presided successfully over it for a term.

The writer's first extended contact with him came through activity in THE AMERICAN INSTITUTE OF CHEMISTS. When with Dr. William Grosvenor, Frederick Kenney and he constituted the INSTITUTE's Committee on Licensing, Kenney's keen practicality, tempered invariably with kindness, was noticeable as always in his dealings.

Later, he assumed the burden of Chairman of the Publicity Committee of the INSTITUTE. He was Chairman of the New York Chapter from 1930 to 1932, and was re-elected to its chairmanship slightly less than a year ago. In the week preceding his death, he had presided at a meeting with the New York Chapter and all of those present had noted his high spirits and apparent excellent health, although his intimates knew that he was suffering from a heart condition which might at any time cause his sudden death.

He had been married since April, 1917, to Julia M. McBride. The union had not been blessed by any children, but his fondness for children was such that his niece and nephew were treated as if they were his own.

In golf, of which he was very fond, he was very proficient and a keen sportsman. Photography, also, was one of his hobbies, more so in recent years.

The INSTITUTE has lost a valiant fighter on its behalf; his friends a sweet and kindly friend. May his soul rest in peace.

Members of THE AMERICAN INSTITUTE OF CHEMISTS are requested to arrange their visits to the World's Fair to coincide with our Annual Meeting at the Fair on May 13, 1939.

Chemist Advisory Council, Inc.

By **M. R. Bhagwat, F.A.I.C.**

THE following excerpts from the experience records of chemists and chemical engineers on the registration files of the Council may prove instructive to the readers of THE CHEMIST. They are selected at random, giving emphasis to persons above the age of forty-five, and indicate the vast amount of experience that could be used by the industry.

A graduate of one of the leading institutions of the class of 1916, 46 years of age, with dependents. Continuous experience of about twenty-two years in the chemical industry covering research, patents, quality control, production, sales-engineering, with particular emphasis on the development of electro-chemical and chemical products and processes from laboratory to manufacturing stage.

●

Age: above 60, with dependents. Post-graduate of one of the large universities. Attended several universities to secure specialized training. Fifteen years' employment in the chemical industry from research chemist to plant supervisor. About eighteen years with one institution as an Associate Professor. Has travelled over various parts of the country and abroad. Health excellent.

●

Graduate chemical engineer 1911. Age: 50, with dependents. More than twenty-five years' experience covering analysis, research and development on a variety of products, eight years of which were spent in government service and, of the remaining, about ten years in the development of synthesis and application of certain unusual specialties. The products derived therefrom, although widely used, are controlled by a small group of manufacturers.

●

Was graduated 1914. Age: 49, with dependents. More than twenty years of industrial experience, eight years of which were spent in research and development in laboratories and the remaining in supervision, sales and organization problems.

●

Was graduated 1914. Age: 45, with dependents. Except for chemical warfare service of two years, continuously employed

for more than twenty years with one company, starting as a junior chemical engineer and holding various important supervisory positions. During the past several years, was in charge of a large operating unit and hence thoroughly familiar with a number of important basic chemicals.

●

Chemist with twenty years' experience states that he was continuously employed in the electrochemical industry on various specialty problems. During his previous connection of more than six years, he was working on the development of formulaes for silvering mirrors; development of improved materials for protecting the silver film of the mirror; development of mirror backing paints, adhesives and decorating materials for mirrors; development of an electrolytic process for depositing copper on the silver film of a mirror, etc.

●

A woman chemist with a post-graduate degree and about fifteen years' experience, starting as a research assistant in the study of proteins and physiological and biochemical problems, continued her research work in special fields of blood chemistry, calcium and phosphorus metabolism, etc.—Age about 35.

●

A post-graduate of about 51 years of age states, "My industrial experience has been in the development of synthetic zeolites for water softening, efficiency surveys and studies in hardwood distillation plants, bark leaching studies in tanneries, experimental varnish making, paint specialties, chemical and baking studies of harvested wheat, studies in food products, etc." In addition to this, he has taught a number of years and published important papers covering his researches.

●

A post-graduate, 48 years of age, began his career as a teacher during the first seven years and then was engaged as a research chemist for the last twelve or fourteen years, progressively bettering himself to the rank of Chief Chemist with the organization.

●

Graduate chemist. Age: 43 years, with dependents. Employed in the chemical industry from 1917 to 1938 in analysis, research and supervision with experience in general chemistry, common and rare gases, foods, ferrous and non-ferrous metals, pharmaceuticals — with special reference to emulsions and ointments.

COUNCIL

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Vice-President, J. W. E. Harrisson
Secretary, Howard S. Neiman
Treasurer, Burke H. Knight

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Norman A. Shepard
Maximilian Toch
Lloyd Van Doren
Gerald Wendt

CHAPTER REPRESENTATIVES

New York	*Niagara*	*Philadelphia*	*Washington*
W. D. Turner	A. W. Burwell	Gilbert E. Seil	Henry G. Knight

March Meeting

The one hundred and sixtieth meeting of the Council of The American Institute of Chemists was held at The Chemists' Club, 52 East 41st Street, New York, N. Y., on March 14, 1939, at six o'clock p. m.

Robert J. Moore, president, presided.

The following officers and councilors were present: Messrs. R. A. Baker, F. G. Breyer, J. W. E. Harrisson, B. H. Knight, H. G. Knight, R. J. Moore, H. S. Neiman, G. E. Seil, N. A. Shepard, and M. Toch. Mr. Ira Paul and Miss V. F. Kimball were present.

The minutes of the previous meeting were approved.

The Treasurer's report, showing a bank balance as of March 10, 1939, of $3527.67, which includes $1000.00 borrowed from the bank, was read and accepted.

Mr. Knight, to whom a letter from the City of New York Civil Service Commission had been referred, reported that no action was necessary on this matter until further notification.

Upon motion made and seconded, it was decided not to have a medal award at the Annual Meeting to be held at the World's Fair, but to have the medal award take place in the Fall.

Upon motion made and seconded, the following colleges selected by the Pennsylvania Chapter for Student Medal awards were approved: University of Pennsylvania, University of Pittsburgh, Pennsylvania State College, Temple University, Bucknell University, Drexel Institute of Technology, Philadelphia College of Pharmacy and Science, Lehigh University, Lafayette College, Allegheny College, Franklin and Marshall College, Villanova College, Saint Joseph's College, and the University of Delaware.

A report from Dr. W. T. Read, Chairman of the Committee on Membership, was read.

The request of Mr. N. A. Laury for

reinstatement to membership was approved.

Upon motion made and seconded, the Committee on Licensing was requested to prepare an introductory statement and summary to accompany the License Bill, and to send copies of this statement to those who wish further information about the reasons for such a bill.

Upon motion made and seconded, the Secretary was requested to prepare suitable resolutions on the death of Mr. Frederick Kenney, to spread them upon the minutes, and to send a copy to his family.

The Committee on Licensing reported and was requested to continue its efforts to secure the passage of a bill for New York state chemists.

The Committee on Nominations reported that the following Fellows had been nominated to appear on the nomination ballot for the positions of three councilors to be filled at the Annual Meeting in May: M. S. Anderson, Donald H. Andrews, H. Jermain Creighton, C. C. Concannon, Raymond Kirk, H. G. Knight, Maurice L. Moore, Foster D. Snell.

A letter from Dr. James H. Hibben, Chairman of the Committee on Economic Welfare, was read, reporting on the progress of the Department of Labor survey of chemists.

A letter from Mr. Lawrence Greenspan was referred to the Committee on Ethics.

The following new members were elected:

FELLOWS:

Heckel, James E.
(1939), *Technical Salesman*, R. T. Vanderbilt Company, Inc., 230 Park Avenue, New York, N. Y.

Makower, Benjamin
(1939), *Chemist*, Bureau of Chemistry and Soils, U. S. Department of Agriculture, Washington, D. C.

Marshall, Housden L.
(1939), *Assistant Chemist*, Bureau of Chemistry and Soils, U. S. Department of Agriculture, Washington, District of Columbia.

Marshall, Louis
(1939), *Junior Chemist*, Navy Department, 29th Street and 3rd Avenue, Brooklyn, N. Y.

Swan, William O.
(1939), *Head*, Department of Chemistry, Virginia Military Institute, Lexington, Virginia.

Van Vorst, Amos R.
(1939), *Technical Representative*, Aluminum Company of America, 230 Park Avenue, New York, N. Y.

JUNIORS:

Roe, Edward T.
(J.1939), *Junior Chemist*, Bureau of Chemistry and Soils, U. S. Department of Agriculture, Washington, District of Columbia.

Tabenkin, Benjamin
(J.1939), *Junior Chemist*, Bureau of Chemistry and Soils, U. S. Department of Agriculture, Washington, District of Columbia.

Zahn, Kenneth V.
(J.1939), *Junior Chemist*, Bureau of Chemistry and Soils, U. S. Department of Agriculture, Washington, District of Columbia.

There being no further business, adjournment was taken.

The program for the Annual Meeting of the INSTITUTE will include a tour of the World's Fair personally conducted by Gerald Wendt, F.A.I.C., Director of Science and Education at the Fair.

CHAPTERS

New York

Chairman, Frederick W. Zerban

Secretary-treasurer, D. H. Jackson
17 John Street
New York, N. Y.

Council Representative, W. D. Turner

A meeting of the New York Chapter was held on February 17, 1939, at The Chemists' Club, New York, N. Y., at which Mr. Ernest R. Bridgewater, F.A.I.C., Manager, Rubber Chemicals Division, E. I. du Pont de Nemours and Company, spoke on the "Advantages of Chemical Training in Technical Sales Work". The late Frederick Kenney, Chairman of the New York Chapter, presided.

Mr. Bridgewater stated that a few of the things that it takes to achieve commercial success in the highly organized industrial society in which we live are really very simple. A successful man in any commercial enterprise is a gentleman who is skilled in the art that he is trying to practice. Success in industry today requires first of all, a man who is honest, straight-forward, square-shooting, a man who commands the respect of his associates, and the respect of everyone whom he has to contact. That is, a gentleman who is practiced in the art of living with other men. But aside from being a gentleman who is aware of the ways of the world and skilled in the art of living with other men, it takes a bit more than that, for to be truly successful, he must also be skilled in the art which he is trying to practice. A technical education, particularly, helps a man to acquire those skills, develops in him habits of mind which make it a great deal easier for him to become skilled in his art. A technical education should teach a man to observe keenly, to draw logical conclusions based on the observations which he gathers in with his five senses, and to acquire a challenging habit of mind that banishes superstition. So, an education, particularly a technical education, does help a man to acquire the technical skill which it is difficult, although by no means impossible, for him to acquire without that advantage.

These basic requirements for commercial success apply as much to success in production management as they do to sales management or salesmanship. They apply, in fact, to all commercial ventures. A research chemist has exceptional need of those orderly habits of mind and that habit of challenging widely held beliefs which are fostered and developed by sound technical education. The research chemist, perhaps, has less need of that ability to live with other men, although he is by no means free from the need of that ability. But certainly the plant manager has more need of that particular kind of social skill than the research chemist, because he is forced by the nature of his vocation to come into contact with more men. It is a larger portion of his job to sell himself to his employees and to his associates.

The salesman also has great need of that social experience, because he, by the nature of his vocation, is forced to come into contact with a great many men and is required, if he is to succeed, to plant his ideas into the minds of other men, but hardly to a greater degree than is the production manager required to display that skill.

What kind of technical skill does the salesman need? The salesman needs technical skill in the arts that are practiced by his customers. He requires little or no skill in the arts that are practiced by those employees of his corporation who are engaged in producing the goods that he has to sell. But if he is a good salesman, he ought to know as much, or, if possible, more about the technical problems that face his customers than his customers themselves know. That means that a salesman who is selling manufacturers' goods to firms who are engaged in chemical industries ought to know something about the particular kind of chemical industry that is practiced by his customers. I use that term "chemical industry" in the broad sense to denote any industry that is engaged in changing the constitution of matter, that is engaged in transforming its raw materials, rather than in merely changing their shape.

A salesman who is selling chemicals need not necessarily have any chemical skill at all. Suppose you are selling refrigerants. They are chemicals into whose research and development has gone some of the best chemical brains, but if you are a good peddler for refrigerants you need know nothing about the chemistry, or about the chemical processes by which coördinative fluorinated hydrocarbons are made. However, you ought to know a great deal about refrigeration engineering.

On the other hand, you may not be selling chemicals at all, but if you are selling machinery, files, evaporators, what-not, to a chemical manufacturer, you have less need to be skilled in the arts of metal working which are the skills required by those who are engaged in producing the apparatus and equipment you have to sell, than to be skilled in the chemical arts practiced by your customers. Hence, the kind of selling in which chemical knowledge is required cannot be defined by the offhand statement that one who sells chemicals would do well to know something about chemistry. It is much more accurate to say that one who sells to firms or individuals who are engaged in the practice of commercial and industrial chemistry ought to know something about the particular branch of industrial chemistry that is practiced by his customer.

You sometimes hear it said that the day of the high pressure salesman is gone. That is erroneous, at least so far as the sale of manufacturers' goods, manufacturers' raw materials, and manufacturers' apparatus and equipment is concerned. In that respect the day of the high pressure salesman was never here. That type of commodity was never sold, in the true sense of the word, until it was sold by men who were not salesmen but by men who knew their customers' business so well that their customers were able to conduct their affairs much better with their advice than without it. Those skills, the knowledge of the arts that your customer is trying to practice, are usually not acquired in any institution of learning. All that can be acquired in an institution of learning is the habits of mind which enable one to acquire the art more readily, and a few basic fundamental facts of science which enable one to reason not only on the basis of his own observations, but on the basis of the observations of the myriad of distinguished

scientists who have gone before him, who took the pains and had the kindness to record their observations and conclusions.

So, if you have a son who wishes to sell apparatus and equipment to a chemical manufacturer, who in turn wishes to sell chemicals to another chemical manufacturer, I am sure that you will give your son an excellent start toward success in his chosen profession by providing a chemical education for him. But he will not be competent to sell ceramic chemicals until he has learned the ceramic arts. He will not be competent to sell rubber chemicals until he has learned the rubber art, and so on. Today, he is exceedingly likely to fail in selling chemicals, in selling products, or apparatus, or equipment to any chemical industry, unless he has first acquired an intimate and detailed familiarity with that art, because whereas, before the War he did not have the competition of men who do know the customers' business, today, he will find that the salesman with whom he has to compete are salesmen who know their customer's business.

I think that salesmanship, if there is such a thing, is just as simple as that. A salesman is a gentleman. He is a gentleman who is skilled in the art of living with other men. He is a gentleman who knows his customer's business, who knows his customer's business more intimately and in more detail than his customer, himself, knows it, if that is possible, and it not infrequently is. He is intellectual, honest, has an inquiring habit of mind. He is a square-shooter. He has not only a superficial knowledge of his customer's business, but he has a detailed practical knowledge which has been gained at some time in the past by actually practicing the arts which his customer is engaged in practicing.

I might add that this is true of selling, not only in chemical industries but in selling in all industries. The facts about technical selling are so apparent, so clear, so simple, that any more words that I might attempt to use in presenting the subject would confuse rather than elucidate upon it.

The discussion following this talk was opened by Mr. Charles Lichtenberg, vice-president of the Resinox Corporation of New York.

Niagara

Chairman, William R. Sheridan *Vice-chairman,* Maurice C. Taylor

Secretary-treasurer, Carl H. Rasch
1212 Oliver Street
North Tonawanda, N. Y.

News Reporter to THE CHEMIST, George W. Fiero

Council Representative, Arthur W. Burwell

February Meeting

The February meeting of the Niagara Chapter was held Tuesday evening, February twenty-eighth, at Norton Hall, University of Buffalo. The speaker of the evening was Captain L. K. Doughty of the U. S. Coast Guard Service. Captain Doughty first briefly traced the history of the Coast Guard Service, stating that it is the oldest military organization under the constitution —the first commission granted by President Washington was to a revenue officer. The Revenue Service was first

organized in 1790 at the request of Alexander Hamilton to prevent smuggling and piracy. Later, because of numerous shipwrecks on the Atlantic coast, the Life Saving Service was organized, and at the present time maintains two hundred and seventy-six stations. The two services were merged in 1915 and became known as the Coast Guard Service. Captain Doughty stated that the Coast Guard Service by itself is the seventh largest navy in the world.

He then described the activities of the Coast Guard which in times of peace operates under the Treasury Department, but in the event of war immediately becomes a part of the navy. Various methods of life saving were described which involve the use of the gun for ships close to shore, boats propelled by oars for shipwrecks beyond the range of the gun, and motor boats for more distant wrecks. In addition to life saving and prevention of smuggling, the Coast Guard has many interesting duties such as charting the compass error, charting icebergs, preventing illegal whaling, escorting seals from mid-Pacific to the north during breeding season, ministering medical aid, justice, etc., to the Eskimos, etc.

Coast Guard stations are maintained not only on the seacoast and islands (such as Hawaii), but also on the Great Lakes. During severe floods, the Coast Guard boats are transported inland as was illustrated in the Louisville flood. Airplanes are used as ambulances to remove stricken people from ships at sea and are also employed to search for moonshiners, smugglers, etc. The motto of the service is "Always Ready".

Next month's meeting will be addressed by President Robert J. Moore on the licensing of chemists. This meeting will be held at Niagara Falls.

Pennsylvania

Chairman, George Russell Bancroft *Vice-Chairman*, Walter L. Obold

Secretary-treasurer, Harry C. Winter
The Biochemical Research Foundation
133 South 36th Street
Philadelphia, Penna.

Council Representative, Gilbert E. Seil

January Meeting

The Pennsylvania Chapter of THE AMERICAN INSTITUTE OF CHEMISTS held its regular meeting on January twenty-fourth in the Christian Association Building, Philadelphia, Penna., forty-eight members and guests attending.

At the short business meeting following an informal dinner, Dr. Bancroft completed the Membership Committee by appointing Drs. Arthur Osol, Addison Angus, and C. M. Connor to serve with Drs. C. W. MacMullen and E. L. Haenisch (Chairman of that group) who had been appointed at an earlier date.

The speaker of the evening was Dr. Herbert K. Alber, head of the microchemical department of the Biochemical Research Foundation of the Franklin Institute. He received his training under F. Emich and F. Pregl at the Technische Hochschule, Graz, Austria. Before coming to this country to join the faculty of New York University, he served as visiting lecturer at Stockholm, Sweden, and Berne, Switzerland.

In his lecture, "Microchemistry in Industry", Dr. Alber pointed out that microchemistry is simply chemistry on a small scale, working with smaller amounts in smaller apparatus than that traditionally used in the laboratory. Obviously the fundamental laws of chemistry and physics cannot be changed by lowering the amounts of material from one gram to one microgram, the unit in microchemical analysis. (One microgram is 10^{-6} gram or approximately the weight of a cotton fibre three mm. in length.) Although the reaction takes place in the same way as with the larger amounts, the precipitate can no longer be observed or collected in the usual manner. Microchemistry, then, is the application of new techniques using smaller apparatus suitable for handling the smaller amounts of material.

"The great advantages of microchemistry are obvious. The methods save time up to fifty per cent, material up to ninety-nine per cent, make analyses possible where the small amounts available eliminate ordinary procedures—in short, they save money, a very important feature to the industrialist. Dangerous processes and explosive substances can be investigated with a greater degree of safety. Trace analysis, fundamentally important in all branches of industrial activities, can be applied only by the logical combination of both macro- and microchemistry, the latter being used in the final stages of the concentration of the trace and its identification."

The speaker discussed a variety of problems taken from practical experience, pharmaceutical analyses, mineral analyses, metallurgical analyses, industrial dust analyses, analyses of valuable objects of art, and analyses in criminal investigation. Each of the examples was selected to emphasize the techniques utilized in the solution of the problem. Standard micro-techniques for qualitative, semi-quantitative and quantitative analysis, as well as micro-procedures specially adapted to specific problems were explained in detail. Many very interesting Kodachrome slides of crystalline precipitates, minerals, and analytical tests used in microanalysis were shown to give the audience a better mental picture of the actual laboratory observations.

Following the general discussion of the talk, the audience showed considerable interest in an exhibit of microchemical apparatus.

The speaker was ably assisted by Dr. William G. Batt of the microchemical department of the Biochemical Research Foundation.

February Meeting

A meeting of the Pennsylvania Chapter of THE AMERICAN INSTITUTE OF CHEMISTS was held on February twenty-first in the Christian Association Building, Philadelphia, Penna., with forty members and guests present.

At the business meeting following an informal dinner, Chairman Bancroft asked Dr. Joseph W. E. Harrisson to serve as a committee on student awards.

Dr. Henry F. Smyth, F.A.I.C., director of the University of Pennsylvania Laboratory of Hygiene, was guest speaker. His address, "Health Hazards of Chemical Industries", included a discussion of variations in toxicity based on personal susceptibility, the portal of entry of toxic materials, physiological reactions induced by various poisons, the requirements for a complete study of potential harmfulness, and methods used to protect the individual against unsafe working conditions. Particularly interesting were a number of cases of industrial intoxication which the speaker described to illustrate what constitutes unsafe working conditions.

Washington

President, Frank O. Lundstrom
Vice-president, Albin W. Warth *Treasurer,* Joseph J. Stubbs
Secretary, A. P. Bradshaw
2121 New York Avenue, Washington, D. C.
News Reporter to THE CHEMIST, G. P. Walton
Council Representative, Henry G. Knight

Executive Committee

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February Meeting

The February Luncheon Meeting of the Washington Chapter was held Tuesday, February twenty-first, in the Department of Agriculture South Building, President Frank O. Lundstrom, presiding. Some forty-two members and guests attended.

Following an announcement, by the President, of the death on January thirtieth, of Dr. Edmund C. Shorey, F.A.I.C. ('28), the assembly rose in silent tribute to Dr. Shorey's memory.

The guest speaker, Dr. Charles A. Browne, Chief of Chemical Research, U. S. Bureau of Chemistry and Soils, had chosen as his theme: "Chemical Aspects of Colonial Museums in England and Holland", but stated that, since the talk would be a brief one, he would confine it to the exhibits and work of the Imperial Institute of Great Britain, at South Kensington (near London), and of the Colonial Institute of Holland, at Amsterdam. In the relatively brief time at his disposal, Dr. Browne covered an enormous array of informative material, listing almost categorically the subjects of exhibits and educational features at the two Institutes, and discussing many of them.

These Institutes are "clearing-houses" of information for all products (mineral, vegetable, animal) of the colonies of the respective Empires. The general scope of their educational and research features may be roughly divided into the subjects: Anthropology, Economics, and General Science, embracing ethnological exhibits and records; exhibits of raw materials and commodities; and technological and commercial exhibits and organized information in the chemistry, biology and geology (mineralogy) of the Colonies.

Besides exhibits, educational features for the public include lectures and dioramas, cultural and sanitation and health aspects being stressed.

Both Institutes maintain large staffs of employees: Librarians, indexers, laboratorians, artisans, specialists in the various phases of photography, workers in the printing trades, editors, etc. As an example of the importance of their publications, mention was made of the well known (to American scientists) *Bulletin of the Imperial Institute,* the scope of its subject matter covering all products produced in the Colonies of the British Empire, seeds, drugs, oils,

minerals, fibers, even soils.

In conclusion, Dr. Browne exhibited a handsome album of photographs, illustrating Colonial native industries producing: Lac, jute, rubber, sisal, copra, oils, sugar, tea, coffee, and spices, and the arts and crafts of India, the collection an example of the thoroughly informative photographic exhibits of these Institutes.

Dr. Browne's address was roundly applauded. After thanking the speaker, President Lundstrom called on the chairman of the Committee on Objectives, Dr. James F. Couch, for a progress report.

BOOKS

LIBRARY GUIDE FOR THE CHEMIST by Byron A. Soule. *McGraw-Hill Book Company, Inc.*, First Edition. 1938. $2.75.

As every worker in the field of chemistry is aware, its literature is becoming so voluminous as to be cumbersome and this despite the fact that it is "probably more adequately classified, more thoroughly indexed, and more consistent in terminology than that of any other science".

The author's object is to provide a means by which the student of chemistry may acquire the key to the work that has been done by his predecessors. The book contains fifteen chapters, commencing with chapters on the arrangement of a library and card cataloguing, and ending with chapters on government publications and literate reports.

The sequence of the intermediate chapters is based on a more or less logical developmental trend: first, the investigators themselves (Biography), then their original reports (Periodicals), then the recurrent summaries, first in Abstract Journals then in Monographs and Reviews, and finally in Chemical Dictionaries and Encyclopedias.

References are given to the excellent lists of periodicals which are available and the book contains only a select list of thirty-three current journals. However, there are many aids to the searcher which include synchronistic tables of seven major chemical journals, a discussion of the character and value of the abstract journals and similar tables.

The chapters on each of the major branches of chemistry treat the literature of those fields in a thoroughly detailed manner; that on organic chemistry, of course, being largely a guide to the use of *Beilstein*; the chapter on patents consists largely of a discussion of patent law; but the following chapter on the patent literature is an excellent summary of the method of using this large repository of our technical information.

The reviewer feels that this book should be the basis of a portion of the curriculum of every chemist and, thereafter, will serve him through a lifetime of work in keeping available the relevant information on any of his problems.

KARL M. HERSTEIN, F.A.I.C.

AN ORIENTATION IN SCIENCE. C. W. Watkeys, Editor, and H. L. Alling, W. Berry, R. G. Daggs, F. C. Fairbanks, R. W. Helmkamp, J. E. Hoffmeister, C. Stern, R. P. Tittsler, W. E. Van De Walle, and T. Russell Wilkins, all of the University of Rochester. *McGraw-Hill Book Company, Inc.*, New York, 1938. x + 560 pp. 14.5 x 22.7 cm. $3.50.

An *Orientation in Science* is intended to aid in the unveiling of science and to help the average person to understand "the wonders of science . . . What the average person needs is not a great mass of knowledge, but an understanding of a relatively few simple principles on which all the various branches of science rest. Before he can understand science as a whole, he must know something of the story of science and the development of those principles of thought and procedure by which it has arrived at its present state, and by which it sets a new course for the future".

An *Orientation in Science* is written in an interesting style, appears to be well edited, and reads easily. "Science is transformed in this book from a mysterious being into an understandable, enjoyable, and useful field of knowledge that is indispensable to an understanding of the modern world."

This orientation "acquaints the student first of all with the scientific method of thought and procedure; secondly, it gives him a bird's-eye view of the principles and problems underlying various branches of science; thirdly, it permits him to see the relation between one field of science and others. The student develops perspective. Having achieved it, he is prepared to choose one or more particular branches of science and study them profitably in detail. The individual trees no longer hide the forest".

Eleven pages are devoted to the introduction by Watkeys, seventy-two to astronomy by Fairbanks, thirty-three to Part I of geology by Alling, forty-seven to Part I of chemistry by Helmkamp, fifty-seven to physics by Wilkins, eighteen to Part II of chemistry by Helmkamp, seventeen to Part II of geology by Alling, seventy-seven to biology by Stern, thirty-one to paleontology by Hoffmeister, forty to physiology by Daggs, thirty-seven to bacteriology by Tittsler, thirty-six to psychology by Berry, forty-eight to mathematics by Watkeys, and eighteen to the scientific method by Van de Walle. The index covers eighteen pages.

The reading matter is amplified by the use of a number of tables and by the use of two hundred and eighty-one figures. The figures are both explanatory and descriptive. A number of pictures of pioneers in the field of science are included.

With each section written by an authority in his field, and the book edited as a unit, *An Orientation in Science* is deserving of careful consideration by those who offer orientation courses.

—Ed. F. Degering, F.A.I.C.

Food Industries Manual. Edited by H. B. Cronshaw and G. W. Lacey. *Leonard Hill, Ltd.* London. American Agents: *Chemical Publishing Company*, New York. 1938. 8th Edition. 9 sections. 450 pp. 11 x 8½". $4.00.

This is a technical and commercial compendium on the manufacture, preserving, packing, and storage of food products, compiled by W. B. Adam, J. Valentine Backes, W. L. Davies, T. H. Fairbrother, F. Hirst, A. E. Ottiker, A. Samson, and S. A. Wilson.

Section 1, compiled by T. H. Fairbrother, deals with "Wheat, Milling Flour, Baking, Flour Confectionery". Topics dealing with baking are arranged alphabetically, and include the chemistry of baking, commercial recipes, colors with structural formulas, milling machinery, cake making with comparative recipes, analysis of prepared ingredients, bread improvers, a thorough discussion

of wheat, also pests and how to eliminate them.

Section II covers "Sugar Confectionery, Chocolate, Jams, Jellies", compiled by J. Valentine Backes. The following subjects are included among others, cocoa, cocoa moth, dextrose, jam manufacture, jelly manufacture, marmalade, sugar confectionery classification, and thermometers for sugar boiling.

Section III on "Canning" is compiled by F. Hirst and W. B. Adam. Topics range from acidity, cookers, hydrogen swells, springers, and perforations, tin in canned foods, to enzymes and yeasts.

Section IV, on "Meat Products" is compiled by A. Samson. In addition to specific information on the subject, material is included on by-products from glands, with sketches; curing of bacon and ham, flavorings, heat penetration with graphs, and vacuumizing machines.

Section V consists of seven pages of "Formulae for the Dairy Industry" compiled by A. E. Ottiker, S. A. Wilcox, and W. L. Davies. Several tables give the composition of milk, fluid milk products, English cheeses, dried milk and dried milk products; a table for correcting lactometer readings to 69° F.; methods for the determination of fats, acidity, the enzyme phosphatase, and formulae involving whole milk, skimmed milk, cream, butter, water, adulteration, etc.

Section VI consists of information on "Packing, including Packing Materials, Containers, and Packing Machinery". Articles are included on chocolate packaging, closures, food laws, tinplate, and also transparent wrappings.

Section VII is entitled "Food Storage and Refrigeration including Insulation, Air Conditioning, etc". The topics include chocolate manufacture, the storage of eggs, fruit storage and transportation, insulation, and a chart of the storage temperatures of about one hundred foods.

Section VIII contains nine pages of charts on the "Composition of Foods", listed under meat products, poultry, fish products, eggs, dairy products, fats and oils, soups and broths, cereal products, vegetables, condiments, etc., fruits, berries, nuts, alcoholic beverages, and other beverages. For each food item throughout, the continuous chart gives per cent by weight of protein, fat, carbohydrate, and calories per 100 grams. About one thousand edibles are listed.

Section IX is a bibliography on "all subjects likely to interest those engaged in the process industries. More than two thousand books and pamphlets are listed in the fields of bacteriology, biochemistry, pure chemistry, engineering and mechanics, fuel technology, physics, power production, soap industry, sugar confectionery and sugar manufacture. The list is not limited to British books and most of the familiar American texts appear here.

This manual is what the compilers and editors planned it to be, a collection of "all information concerning what has now become an established industry", and a comprehensive library of up-to-date material for the use of the food industry. It is thumb-indexed as a guide to its sections which contain, in addition to technical manufacturing information, formulae for making hundreds of commercial food products.

—M. LAMPE

The new directory of the Association of Consulting Chemists and Chemical Engineers, 50 East 41st Street, New York, N. Y., may be obtained gratis on application to them.

NORTHERN LIGHTS

By Howard W. Post, F.A.I.C.

Apparently government regulation of the oil industry is not without its trials and tribulations in British Columbia. We read that certain disputes between a group of oil concerns, including Standard and Texas, and the province are still being carried on in the courts with no tangible results as yet—at least, no actual settlement. Reviewers have stated that whatever the verdict, the matter will undoubtedly be carried to a higher court.

A brief summary may not be out of place. The industry in British Columbia states that it is operating at a considerable loss, one and a half million annually to be exact. This money is supposed to represent the saving of the gasoline consuming public, by the grace of an act of the Provincial Legislature. The province takes the stand that it has the right to enact such laws as may seem fit in the public interest, even though it might see those interests now one way, now another. As for the financial loss to dealers, etc., the law-makers say that they should see that the price charged them by the parent organizations is correspondingly reduced.

⊕

We understand from *Canadian Chemistry and Process Industries* that ten new gold mills have recently been set up in British Columbia. In addition to the good omens thus represented, other metallic industries are continuing at normal speed, for instance copper. The total export of lumber for the province was much greater in 1938 than in the previous year. Under this latter heading comes the item of increased exportation to the United States under the recently promulgated trade treaty.

⊕

The Bureau of Mines, Ottawa, has just opened its new Industrial Minerals Laboratories, designed especially for work in ceramics and in certain other fields, more or less distantly related. Included among the various items of equipment will be found a 200,000-pound hydraulic compressor, a 200,000-pound Universal testing machine, a tensile testing machine of 2,000 pounds capacity and apparatus for the determination of the cementing value of various materials.

⊕

A note in a recent issue of *Canadian Chemistry and Process Industries* advises readers to make their reservations early if they wish them at the forthcoming meetings at London, Ontario. Reason: The King and Queen are to be there on Wednesday, June seventh.

THE SCIENCE ANGLER

Kenneth E. Shull, J.A.I.C.

Scientists have long speculated as to whether or not the odors of aromatic substances are due to the emanation of material particles. Now it is a generally, but not universally, accepted fact that they are.

Evidence in support of this theory comes from a scientist who has succeeded in actually photographing odors. In his ingenious method the odiferous material is suspended over a clean mercury surface on which is spread a thin layer

of talc. As the redolence impinges upon the surface, the tale is gradually pushed away from the center. Thus a design is formed which is said to be characteristic of each type of odor and which can be readily photographed.

This method may give great satisfaction to some in that they may be able to see the malignant aroma which permeates one's nostrils from the breath of a garlic eater.

It is perhaps safe to say that few analytical chemists are familiar with the process of chromatographic adsorption; yet this method, discovered by Tswett about the beginning of the twentieth century, has rapidly come into importance during the past five years.

In brief, the method depends upon the fact that when mixtures of certain organic substances, dissolved in a suitable solvent, are passed through a tube containing an adsorbent (aluminum oxide, etc.) the components are selectively adsorbed from the solution, and form in different zones. After the adsorbent has dried somewhat it is removed from the tube and cut into sections corresponding to the zones. From each of these the individual substances are extracted and finally identified or, in some cases, estimated quantitatively.

Anæsthesia has been in use much longer than the average person realizes. Previous to the utilization of drugs for somniferous purposes, a not-too-gentle tap on the cranium served to render the patient (sometimes permanently) insensible to pain.

Historical records indicate that as early as the third century the drug *Cannabis sativa* or Marihuana was being used by Chinese doctors to carry their patients to dreamland and thus make painless a painful operation.

These few lines are penned specifically for those who gain delight in disseminating so-called fish stories.

One sage of the laboratory, with the blood of a fisherman coursing through his veins, has applied his scientific knowledge to determining the speed with which various fish travel in water. His results show that the swordfish is the Sir Malcolm Campbell of the sea, since it sometimes attains a speed of sixty miles per hour. Other speedsters include blue shark, twenty-four miles per hour; salmon, twenty-three miles per hour; trout, twenty-three miles per hour; and pike, fifteen miles per hour.

Substantiated by actual experiment—this is no fish story.

One can hardly scan the pages of a modern scientific journal without learning of the development of a new synthetic plastic.

Recently, while "thumbing our way" through *Chemical Industries*, our attention was directed to an article describing a luminous molding powder. This unusual product possesses all of the advantages of the ordinary molding powders and, in addition, is capable of becoming luminescent after exposure to a strong source of light. It should thus find wide application in the fabrication of indicator buttons, house numbers, street signs, and perhaps even the elusive collar button.

The Swiss are not only great climbers of mountains; they are prodigal drinkers of milk as well. As a matter of fact, they lead the world in this phase of gastronomical activity. According to reports, each Swiss lad and lassie consumes on the average of two hundred and thirty-two quarts of milk a year.

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ORGANIC DEVELOPMENT CHEMIST, B.S., A.A.I.C. Age 35. Has had eleven years of practical laboratory and plant experience with a large manufacturer of dyestuffs. Desires employment with an organization in the consulting field. Please reply to Box 41, THE CHEMIST.

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CHEMIST for sales service work in the field of flour. Must have flour milling experience.

CHEMIST experienced in the field of breakfast cereals for research and production.

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